# Mentoring Toward Technology Use: Cooperating Teacher Practice in Supporting Student Teachers

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**Abstract**

*This paper investigates the mentoring practices of 16 cooperating teachers as they prepared student teachers to integrate technology into teaching and learning activities. Data were gathered from multiple sources during a semester of student teaching. A complex variety of contextual and conceptual factors influencing the integration of technology into student teaching experiences are presented, including access to technology, on-site support, and beliefs about mentoring. Findings describe the practices of cooperating teachers in mentoring student teachers toward technology use. In order for student teachers to learn how to support student-centered lessons with technology, they need knowledgeable mentor teachers and adequate access to technology to practice and develop those lessons. Recommendations for other school district/university partnerships attempting to integrate technology in field experiences include the implementation of frequent professional development sessions for mentors that help them build knowledge about how to teach in reform-minded ways with technology and how to mentor student teachers to teach in ways consistent with reform standards. Mentors should be introduced to new practices integrating technology with curriculum-based, student-centered activities that expose them to new models for teaching and learning and learn to encourage novices to teach in similar ways through modeling, practicing, and analyzing teaching together. (Keywords: technology integration, teacher practice, technology mentoring, field experience, professional development, school district/university partnerships.)*

## INTRODUCTION

Student teaching is a critical component in the professional preparation of preservice teachers to establish practices they will use in future settings (Feiman-Nemser, 1983; Guyton & McIntyre, 1990; Strudler, McKinney, Jones, & Quinn, 1999). The factory school model created in the early part of this century that prepared students for the relatively low-level jobs of the past is inadequate to prepare students for the knowledge work and the increased use of technology that characterize the job needs of the 21st century (Darling-Hammond, 2000). Student teachers need to be guided by knowledgeable teachers to meet this challenge of preparing students for their place in tomorrow's world (Moursund & Bielefeldt, 1999). Cooperating teachers play a central role in meeting this challenge. However, we have few explicit accounts

of what cooperating teachers do and how they actually work with student teachers (Cochran-Smith, 1991). This study addresses this gap and provides insight into the practices of cooperating teachers in supporting student-teacher use of technology.

## REVIEW OF THE LITERATURE

As more technology is placed in preK–12 classrooms, the need for knowledgeable teachers to use these tools effectively becomes a pressing issue. Research on classroom use of technology has emphatically determined that teachers are the key for effective classroom use of technology (Cooper & Bull, 1997; Sandholtz, Ringstaff & Dwyer, 1997; U.S. Congress, 1995; Wenglinsky, 1998; Willis, 1993). However, although the majority of teachers now have a computer in their classroom, in many cases it is not used for instruction often due to lack of prior experience in using this tool (Becker, Ravitz, & Wong, 1999; Hope, 1998; Trotter, 1999; U.S. Congress, 1995).

Teacher preparation and ongoing professional development are essential ingredients for powerful use of digital content in the classroom (Trotter, 1999), and national reports have highlighted the need to prepare teachers who are knowledgeable about how to use technology to support teaching and learning (Moursund & Bielefeldt, 1999; NCATE, 1997). Given the increased access to technology and the emphasis on using those technologies for curriculum-related applications, schools of education are challenged to improve the instructional technology preparation of their students.

Thomas, Larson, Clift, and Levin (1996) found that "when technology topics are infused throughout meaningful, contextualized experiences in university and school settings, student teachers are more apt to embrace, model, use, and incorporate technology into their instructional planning and classroom organization" (p. 6). However, a national survey revealed that although most K–12 classrooms where student teachers were placed had technology available, most student teachers did not routinely use technology during the experience or work with master teachers or supervisors who could guide their use of these tools (Moursund & Bielefeldt, 1999). The survey indicated that less than half of preservice students had opportunities to apply instructional technology applications in K–12 classrooms and that cooperating teachers were often unable to advise students on these issues. Adding complexity to the issue of integrating technology in field experiences is the problem of locating technology-using teachers for these placements (Strudler & Wetzel, 1999).

An approach for addressing this problem is the creation of school district/university collaborations to develop technology skills of cooperating teachers (Cooper & Bull, 1997; Hasselbring et al., 2000; Strudler & Grove, 2002; U.S. Congress, 1995). Studies have begun exploring professional development options for cooperating teachers in order to create technology-rich placements for preservice students (Brush et al., 2003; Dawson & Nonis, 2000; Wetzel, Zambo, Buss, & Padgett, 2001). These approaches have included: a workshop model with additional training sessions during a semester for K–8 teachers who agree to serve as models for preservice students (Wetzel et al., 2001); a field-

based technology integration initiative in which a teacher education student is paired with an inservice teacher to work collaboratively in identifying, developing, and implementing technology-supported lessons (Dawson & Nonis, 2000); and a field-based technology integration model in which graduate students deliver model lessons to preservice teachers who then develop similar activities for delivery in school district classrooms with just-in-time support provided during implementation of the lessons (Brush et al., 2003).

Although results from these studies have acknowledged the important role cooperating teachers play in supporting student-teacher use of technology, findings have focused on the impact on preservice teachers. Additionally, in recent research, preservice teachers have recognized this impact and identified support from the inservice teachers during field experiences as a salient factor in their use of technology (Wilson, 2003). There is growing support for the need to hear more from cooperating teachers concerning their work as mentors (Kahn, 2001; Koerner, 1992; Tjeerdsma, 1998; Veal & Rikard, 1998) and their ideas about what they are mentoring toward (Odell & Huling, 2000; Wang & Odell, 2003). Recent studies have begun to provide opportunities for mentors to articulate their experiences with student teachers (Kahn, 2001). Feiman-Nemser and Floden (1986) have suggested that the wisdom of practice derived from teachers' classroom work is an untapped source for providing insights into the improvement of teaching. It is clear that cooperating teachers are an important link in the process for developing 21st century educators. However, little research is available specifically addressing what cooperating teachers think and do in their practice as they mentor student teachers toward technology use.

## THEORETICAL FRAMEWORK

The study was framed in a sociocultural perspective of learning (Brown, Collins, & Duguid, 1989; Feiman-Nemser & Remillard, 1996). Within this overall frame were three layered theoretical dimensions funneling toward a focused look at teachers' practice. The first layer addressed technology contextual dimensions, the second layer addressed mentoring dimensions, and the final layer addressed a technology-effectiveness dimension to identify a cross section of cases for further study.

A sociocultural perspective of learning assumes that knowledge is situated in and developed in the context of its use (Brown et al., 1989). Knowledge about teaching is situated in the activity of teaching, and it grows out of practice in authentic situations (Perry, Walton, & Calder, 1999). In a mentor-novice relationship, the sociocultural perspective emphasizes that interactions with more capable or experienced others are critical in order for novices to acquire knowledge beyond the independent level of exploration (Vygotsky, 1978). Thus, cooperating teachers are in a position to support and mentor student teachers in acquiring skills and practices, such as technology integration methods, that student teachers are unable to develop by themselves (Feiman-Nemser & Remillard, 1996).

For the mentoring dimensions, this study drew on the methodology of Wang (2001), who used interview strategies to explore the relationship between context and mentoring practice, and Odell (1986), who used journal/log strategies

to identify mentor practices based on the nature of assistance offered to novices. It also drew on the methodologies of Feiman-Nemser (2001), who used a case-study approach to capture the words and terms introduced by one exemplary mentor to characterize conceptual approaches to mentoring practices.

In addressing the technology-contextual dimensions, studies investigating the technology practice of teachers (Becker et al., 1999; Ertmer, Gopalakrishnan, & Ross, 2001) suggest that constructivist-oriented teachers tend to use technology in more powerful ways that engage students in the learning process. Becker et al. (1999) classified technology use in the classroom in ten categories ranging from word processing to use of the Internet and computer simulations. They also noted that important factors in the level of technology use with students were the level of access teachers had to computers, and teachers' skill levels with technology.

The technology effectiveness dimension in this study was based on the framework of Jones, Valdez, Nowakowski, and Rasmussen (1995), who posited that the intersection of two continua—learning engagement and technology performance—could be useful in defining technology practices that support student learning. Questions from Becker et al.'s (1999) teaching philosophy criteria were used to define the component of learning engagement on the continuum. The Staff Self-Evaluation Rubric (Bellingham Public Schools, 2001) was used to define the continuum of technology performance. This technology-effectiveness component was then used to identify a cross section of cooperating teachers for further case studies.

The purpose of the study was to describe the mentoring practices of cooperating teachers as they prepared student teachers to integrate technology into teaching and learning activities, and to examine the technology contexts and conceptual perspectives about mentoring that affected those practices. Two research questions guided the study:

1. What are the general technology contexts in which cooperating teachers work, and what are their conceptual perspectives about mentoring?
2. What are the mentoring practices of cooperating teachers in preparing student teachers to teach with technology?

## METHODOLOGY

The study was conducted in two phases and employed qualitative methods and descriptive statistics. In the first phase, data were gathered from all cooperating teachers. Then, a second phase of case studies was initiated using purposeful sampling to select a cross-section of information-rich cases of cooperating teachers and their student teachers in order to provide a more holistic picture of the various contexts that can occur during student teaching experiences.

### Setting

The setting for this study was a large, metropolitan school district in the southwestern United States. The participants included 16 volunteers from a pool of 21 cooperating teachers participating in a school district/university

mentoring program. The teachers were clustered at five public school sites: two elementary schools, two middle schools, and one high school. The schools were located in the same geographic area of the school district. All schools had greater than 50% minority student populations, and above average populations of second language learners.

**Participants**

***Phase 1.*** Participants included 16 cooperating teachers. Their years of teaching experience ranged from 3 to 26 years with a mean of 9.4 years. The number of previous student teachers for the group ranged from 0 to 6, with ten (63%) indicating that this was their first student teacher. The cooperating teachers from elementary (n=8), middle (n=4), and high schools (n=4) were enrolled in a series of four monthly mentoring workshops during the semester they worked with student teachers. The full-day workshops were delivered through a K–12 school district/university partnership. The morning sessions focused on mentoring activities and the afternoon sessions focused on technology-rich learning activities to support their student teachers. In addition, an online discussion forum was used to elicit information on how teachers described, defined, and refined their practice with student teachers.

***Phase 2.*** Midway through the study, seven of the16 cooperating teachers were identified as cases for the second phase of the study, and their seven student teachers were invited to become participants. At this point, three of the 16 cooperating teachers were working as "track break alternate teachers" at a school with a year-round schedule and were eliminated from consideration for further study. This was due to their more limited involvement with the student teachers and the lessened opportunity for them to engage in mentoring practices. This left a pool of 13 cooperating teachers from which to select the seven who would be part of the case-study group.

The "Technology Effectiveness Framework" (Jones et al., 1995) was used to identify a cross section of those 13 cooperating teachers in terms of learning, technology performance, and grade level for the case studies. In this framework, learning is represented on the horizontal axis and progresses from passive at the low end to engaged at the high end. On the vertical axis, technology performance is represented from low to high. Selected questions from Becker et al.'s (1999) teaching philosophy criteria were combined to create a score for each cooperating teacher on the axis of learning engagement, from passive to engaged constructivist-oriented learning. Mean scores from all questions on The Staff Self-Evaluation Rubric (Bellingham Public Schools, 2001) were used to define their scores on the axis of technology performance. The intersection of those two scores identified a point in one of four quadrants on the grid. Figure 1 shows the four quadrants, with dotted lines on each axis indicating the mean scores for this pool of participants that were used to determine the quadrant boundaries for this study. Participant scores were identified according to their teaching assignment: elementary school level (ES), middle school level (MS), or high school level (HS). Additionally, those identified for further study include a case number.

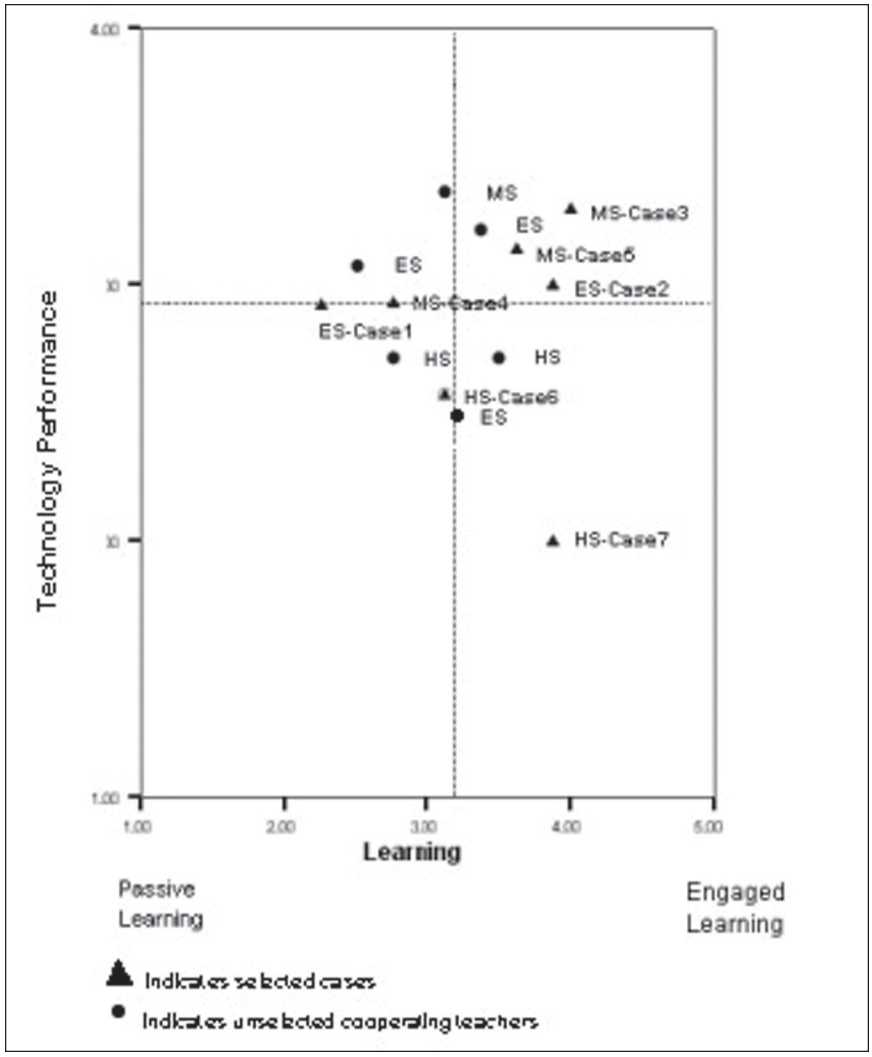


*Figure 1. Matrix of participant scores for technology performance and learning.*

**Data Collection**

***Phase 1.*** Data were collected through multiple venues throughout the semester. In the first phase with all cooperating teachers sources included: the "Staff Use of Technology 2001 Self-Evaluation Rubric" (Bellingham Public Schools, 2001), transcripts of semi-structured interviews (See Appendix, page 108), electronic transcripts from online discussion forums, transcripts of small group discussions among the cooperating teachers during the workshops, artifacts created during workshops, responses from questions J1, J3 and J7 on Becker, Ravitz and Wong's (1999) teaching philosophy survey, field notes, and data from a final questionnaire.

***Phase 2.*** Additional data collected for the second phase included: a second semi-structured interview with the selected cooperating teachers, semi-structured interviews with their student teachers at the end of the semester, and student teacher scores from the "Staff Use of Technology 2001 Self-Evaluation Rubric." All interviews with cooperating teachers took place at respective school sites with most interviews conducted in the teachers' classrooms when students were not present or in nearby conference rooms. Student teacher interviews were conducted privately at the school sites during the final week of their student teaching experience. The first author conducted all interviews using the appropriate semi-structured interview protocol. (See Appendix, page 108.) Each session lasted approximately 30 minutes. All interviews were audio taped, transcribed for data analysis, and copies were sent to the interviewees to check for accuracy, with one teacher correcting an inaccurate term.

**Data Analysis**

***Question 1.*** Analysis for the first question examined two areas of data: the general technology context, and conceptual perspectives about mentoring. These two areas are described as the technology dimension and the mentoring dimension.

For the technology dimension, data from the questionnaires were entered into statistical software to provide descriptive statistics concerning: (a) general access to technology resources such as classroom computers, laptops, or school computer labs; (b) use of technology in the classroom; and (c) professional development with technology. In addition, content analysis from interviews, small group discussions, in-class activities, and field notes generated data concerning additional contextual factors supporting technology use such as on-site and administrative support.

For the mentoring dimension, content analyses from interview transcripts were used to generate data in two areas: beliefs about how student teachers learn to teach, and beliefs about the types of support they need. Analysis of beliefs about how student teachers learn to teach led to construction of six categories for reporting. Beliefs about the types of support needed were analyzed using Odell's (1986) seven categories of support from a functional analysis of assistance to teachers.

***Question 2.*** For the second question on mentoring practices, Spradley's (1980) model for domain analysis was used to uncover the patterns of practices and the relationships among those practices in a holistic context. The technique organizes the elements of practices into domains, which are categories of meaning that include phrases of similar content from a variety of participants.

To identify these domains, content analyses were used to identify all cooperating teachers' phrases from interviews, small group discussions, and online postings that addressed specific instances of mentoring practices with their student teachers. These phrases were categorized into patterns of practices and identified with a cover term. For example, phrases such as "He and I went over the grading program together," and "I showed her how we set up the grade book program" were grouped under the cover term of "show grading pro-

grams." The analysis employed the semantic relationship of strict inclusion in the form of "X is a kind of Y," where X was the cover term for the teacher practice and Y represented the mentoring strategy for technology use—for example, "showing grading programs is a kind of mentoring strategy for technology use." All together, 30 cover terms were constructed from the data. Content analyses from student teachers' interviews were used to verify those practices.

Once the cover terms were identified, a second step of componential analysis was used to discover the patterns (cultural domains) in the practices. Spradley (1980) identified a cultural domain as "a category of cultural meaning that includes other smaller categories" (p. 88). Of the three types of cultural domains, "mixed domains" incorporates both folk terms used by the participants and analytic terms selected by the researcher to label consistent patterns of cultural activity.

In those domains where no single folk term was consistently evident, an early attempt to construct domains by selecting analytic terms connecting to the National Educational Technology Standards for Teachers (International Society for Technology in Education, 2000) proved unworkable. The standards provide general descriptions of "what" teacher practice with technology should be, but not "how" to achieve that practice. Instead, Odell's (1986) functional analysis of assistance provided in a teacher induction program, which focused on articulating teacher mentoring practice and professional culture, provided guidance in selecting analytic terms for the cultural domains.

There were strong similarities between the cover terms for this study and six of the seven categories in Odell's study. Three of the categories were very similar: (a) system information, (b) resources and materials, and (c) instructional. The researchers selected these categories as names for analytic domains in this analysis. Three of the categories were somewhat similar: (a) demonstration teaching, (b) emotional support, and (c) classroom management. These categories were modified to address the current data. One of the categories, environment, which Odell (1986) described as "helping teachers by arranging, organizing, or analyzing the physical setting of the classroom" (p. 27) received little support in the current data set and was not used for analysis.

Mixed domains were then constructed using strict inclusion in the form of "X is a kind of Y" where X was the cover term and Y was the mixed domain. For example, "showing grading programs is a kind of productivity practice." Altogether, six cultural domains were constructed to show the relationships among the 30 cover terms of cooperating teacher practice. Two of the domains used folk terms used by the participants: Modeling Practices, and Support and Challenge Practices. Three of the domains used titles drawn from Odell's (1986) categories: System Information Practices, Resource and Materials Practices, and Instructional Practices. One domain was a term selected by the researchers: Productivity Practices.

The final step in the analysis was to organize the domains and cover terms into a taxonomy. Spradley (1980) defined taxonomy as a "set of categories organized on the basis of a single semantic relationship" (p. 112). Using the means-end semantic relationship "X is a way to do Y," the taxonomy reveals a holistic look at cooperating teacher practices (means) in mentoring student teachers toward technology use (end).

**Procedures**

In the first workshop in September, the study was explained and cooperating teachers were invited to join. Participants were introduced to the online environment and shown how to post a message and response in the discussion area. They also participated in small group discussions focused on sharing technology mentoring strategies used with their student teachers and were given directions in how to record the session, including the date and names of the group members. Those sessions were audiotaped and transcribed for analysis. At the end of the session, approximately 15 minutes was allotted to complete the Staff Self-Evaluation Rubric on technology skills.

During the second workshop in October, participants again formed groups according to grade levels to record the small group discussions on mentoring practices for later transcription. Interview times for the initial interview were scheduled during the following two weeks.

In the third workshop in November, participants again recorded their small group discussions and were given approximately 15 minutes to complete the questions on teaching philosophy. The mean scores from this data, along with the mean scores from the technology use survey were used as previously described to purposefully select the seven participants for the second phase of case studies. Approximately two weeks after the workshop, selections were made and those cooperating teachers were contacted by e-mail. At that time, their student teachers were invited to join the study. All cooperating teachers and student teachers agreed. Times were scheduled for interviews using the second cooperating teacher protocol. (See Appendix, page 108.) Separate times were also scheduled for student teacher interviews using the semi-structured interview protocol. Student teachers were also given approximately 15 minutes to complete the Staff Evaluation Rubric either before or after their interview.

The final workshop was held in December, after the student teachers had finished their student teaching. They were invited to the morning workshop and a hosted luncheon to participate with their cooperating teachers in creating a digital video project. Nine student teachers attended, including five of the case-study participants. During this session, cooperating teachers were given approximately 30 minutes to complete the final questionnaire.

## FINDINGS

In order to provide a picture of the mentoring practices of the cooperating teachers in preparing student teachers to teach with technology, it is helpful to address underlying dimensions that affect cooperating teachers' practice. Each teacher practices in a unique context. Technology practice is affected by general contextual factors that influence use (Ertmer et al., 2001). In addition, mentoring practice is affected by mentors' conceptualization of their role in working with novices (Feiman-Nemser, 2001; Wang, 2001; Wang & Odell, 2003). The first research question explores the technology context and mentoring perspectives of the cooperating teachers. The second research question focuses specifically on their mentoring practices. Data for both dimensions noted in the first question are addressed followed by findings for the second question describing the mentoring practices found in this study.

**Technology Dimension**

This dimension addresses the access to technology and other factors that influenced the technology context of the cooperating teachers. Data are presented in four areas: general access, use in student teaching, additional on-site support, and administrative support factors.

***General access to technology.*** In this study, all of the cooperating teachers had at least one computer connected to the Internet in their classroom. Twelve of the 16 cooperating teachers reported two or more computers in their classroom, and also reported access to a computer lab for student use. Four of the teachers reported only one computer in their classroom and no access to a computer lab during the semester due to school closure for rehabilitation of those labs.

In multi-case analysis involving seven cases studies, the five student teachers in the schools with lab access all reported teaching lessons in which they used technology for presentation of material, as well as lessons in which students used computers. The two student teachers working in the school with no lab access and only one computer in the classroom reported that they were able to teach lessons in which they used technology for presentation of content area topics. However, these student teachers noted that they were not able to plan or teach any lessons in which students used computers. As one student teacher commented, "There's only one computer in the class and we didn't have kids on the computer at all."

Another facet of general access that emerged from this study was the availability of laptop computers. Literature has indicated that laptops provide teachers with convenient access to technology, allowing opportunities to bridge barriers of time and access to accelerate their development of technology skills (Falba, Grove, Anderson, & Putney, 2001; Ronnkvist, Dexter, & Anderson, 2000). In the present study, 10 of the 16 cooperating teachers had school district laptops. Three of those ten teachers were involved in the case-study analyses. All three of their student teachers reported checking out laptop computers for home use that enabled them to explore software for teaching presentations and prepare lessons for student use of technology. A middle school student teacher noted this convenient access: "It was easy just to take it home, work on the laptop, bring it back, attach it to our network and move things over."

***Technology use in student teaching.*** In the area of preparing teachers for future practice, research has indicated that teachers tend to teach the way they were taught (Cuban, 1986; Lortie, 1977). In this study, seven of the 16 cooperating teachers indicated that there were computers in the classroom during their own student teaching. However, only one cooperating teacher reported that his own cooperating teacher modeled a lesson using technology, and two of the cooperating teachers noted that they had taught a lesson using the computer during their student teaching.

In this study, fifteen of the cooperating teachers, including six of the case-study teachers, reported modeling technology use in teaching. In addition, all seven of the case-study student teachers reported that they were able to teach at least one lesson using technology. Although the number of participants in the study is small, the improvements in integrating technology in the student teach-

ing experience are notable. It appears the majority of the cooperating teachers in this study were expanding beyond the notion of teaching the way they were taught by modeling teaching methods that integrated new technologies. Thus, the student teachers were introduced to teaching methods that included the use of technology.

***Additional on-site support.*** Another supporting factor in the technology context that surfaced in the interviews was support from the school-level technology coordinators. Fourteen of the cooperating teachers noted that they referred their student teacher to the technology coordinator in some capacity for support with the integration of technology in their lessons. One teacher commented: "[The technology coordinator] plays a huge role for all of us. So, we use her all the time… I had her come in for a couple of lessons in the beginning so [the student teacher] could see the role of the [technology coordinator] and what you could ask for" (ES Case 1).

Cooperating teachers indicated that technology coordinators gave support to student teachers in many capacities, such as offering advice and materials for lesson planning with technology, coming to the classroom to help with technology lessons, introducing software one-on-one, and arranging for the student teachers to take home software or laptop computers. This is consistent with findings in recent literature that on-site technology coordinators who provide support in both technical and instructional domains are an important factor in supporting teacher use of technology (Ronnkvist et al., 2000), and extends those findings to field experience settings.

***Administrative support.*** In the school context, administrative support was also a factor cited in supporting technology use. During the case-study interviews, although not asked directly about administrative support, two of the cooperating teachers specifically mentioned that support from their administrators was an important factor in their use of technology in teaching. In the words of one teacher, "Over the past three years, the thing that has made a significant difference in the use of technology in the building is that our administrator, [the principal], strongly believes in technology" (MS Case 3). They explained that the vision of their principals for getting technology into the hands of the students led to increased numbers of computers in their classrooms. Though at two different middle schools, each teacher had seven computers in their classrooms, and both of their student teachers reported using technology for presentations and for student learning activities in the classroom. This is consistent with previous research indicating that administrative leadership and support are important factors affecting teacher use of technology (Anderson & Dexter, 2000; Sandholtz et al., 1997), and extends those findings to field-experience settings.

**Mentoring Dimension**

This dimension addresses the conceptual perspectives of the cooperating teachers in addressing their role as mentors. Data for this dimension are reported in two areas: mentor conceptions about how student teachers learn to teach, and conceptions of the types of support student teachers need from cooperating teachers.

***Conceptual beliefs about learning to teach.*** In order to identify their conceptual perspectives concerning their role as cooperating teachers, the participants were asked in the first interview how they believed student teachers learned to teach. There were some consistencies in those beliefs across the population of cooperating teachers. All of the teachers (100%) identified that student teachers learned by doing, by actually getting in front of the students and teaching. For example, one middle school teacher noted:

> You don't learn until you get into the trenches. I don't think there's any other way to say it because you can read about it, you can observe it, you can watch movies on it; but, until you actually get in there, get your feet wet, experience it, that's the only way they're going to learn (MS Teacher 13).

A majority of the cooperating teachers stated that they believed student teachers learned to teach by observing. Fourteen (88%) specifically stated that they learned by observing their cooperating teacher, while ten (63%) mentioned observing other teachers. The value in taking time for reflection and questioning after lessons was recognized by 11 (69%) of the teachers. A middle school teacher noted, "Sometimes, it's hard to talk every single day about how he's doing and how he thinks it went…but we try and set aside 10 minutes after school and say how do you think that went?" (MS-Case 4).

Five of the cooperating teachers (31%) mentioned that students learned to teach by applying their university course work. Only three of the cooperating teachers (19%) mentioned that student teachers' prior experiences and observations as students affected how they learned to teach. One teacher referred to this prior knowledge during his interview: "Well, I don't know whether this is fortunate or unfortunate, but I think most people teach how they were taught; or at least they start off teaching how they were taught" (ES Teacher 8).

***Conceptual beliefs about support.*** The concept of support for beginning teachers has been identified as a central theme underlying mentoring practices (Gold, 1996). Data addressing this concept were drawn from the questions in the first interview in which teachers were asked what they believed student teachers needed from cooperating teachers. Odell (1986) identified seven categories of support in a functional analysis of assistance to new and new to system teachers. New teachers were those in their first year of teaching, and new-to-system teachers were those who had teaching experience in another district but were in their first year in this particular district. The categories included: (a) system information, (b) resources and materials, (c) instructional, (d) emotional, (e) classroom management, (f) environment, and (g) demonstration teaching. These categories were used to analyze the beliefs of the cooperating teachers about the types of support needed by student teachers.

The results indicated that all of the cooperating teachers believed that emotional support was important for their student teachers. This support included observations such as allowing them to be comfortable with asking questions and sharing their reflections on lessons. One teacher characterized the support as re-

assurance: "I think they need reassurance that they're capable of doing this" (ES Teacher 10). Another framed the support as a comfortable relationship that supported communication: "He came to me whenever he had a question, and I think that's important, too, that the cooperating teacher and the [student] teacher have that relationship where they can be open with communication and work together" (ES Teacher 11).

All cooperating teachers also believed that demonstration of teaching practice was critical for student teachers. They thought it was important to have the student teachers actually watch them teach as they modeled specific teaching strategies. One teacher stated it most succinctly when she said, "That's the key, model for them" (MS Teacher 13). An elementary-level teacher noted, "I think the first part of my role is to be a model for them…When they come with theory, I try to do the modeling so they can put that theory into action" (ES Teacher 9). While at the middle and high school level, several teachers noted that they used the strategy of teaching the first class of the day: "I teach the first period of the day so they can kind of see where I'm going and how I would handle the subject matter or content. They're not required to do as I do, but it just gives them an idea" (MS Case 5).

Of the 16 teachers, nine (56%) noted classroom management types of support such as giving guidance related to discipline or to scheduling, planning, and organizing the school day. For example when planning for technology use, one middle school teacher noted: "It's hard to get [the lab] at the time you need it. So, I may plan a week where six or seven of the students aren't doing what the rest of the class is doing and they each get a day on the computer" (MS Case 3). Only four (25%) mentioned environmental types of support, which included items such as how to organize or arrange the physical setting of the classroom.

**Mentoring Practices**

The second research question focused on identifying specific mentoring practices of the cooperating teachers. In this study, cooperating teachers were asked specifically about their practice with student teachers as they mentored them toward technology use. Figure 2 reveals a taxonomic analysis of mentoring practices reported by all cooperating teachers in supporting student teacher use of technology in teaching and graphically displays the findings. Each practice was also confirmed by student teachers during their interviews.

The domain of "System Information Practices" included items that addressed the equipment and system procedures available at each school. Although many of the system procedures for collection of data such as student attendance were uniform across the district, items involving hardware and software resources reflected slight variations from school to school. Some schools distributed software to classrooms; other schools housed the software for checkout in centralized locations. For example, under the cover term of "Exploring software resources," one teacher noted in her online correspondence, "Together we went to the computer lab and looked in the notebooks at all the software we have on site. We discussed what software we could use that would enhance our curriculum and help students to understand the material" (MS Case 5).

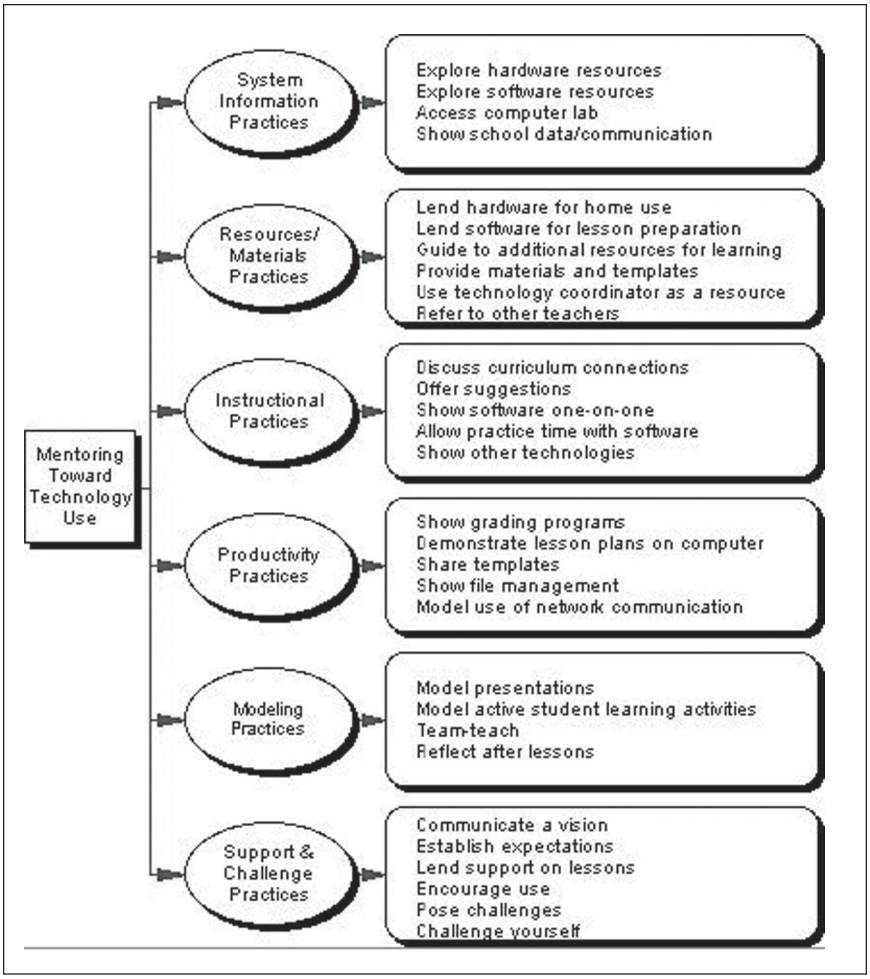


*Figure 2. A taxonomy of mentoring practices of cooperating teachers.*

The domain of "Resources/Materials Practices" included tangible materials that were provided to student teachers to help with their lesson planning, and resources such as other teachers that they could use for planning and implementation of lessons. For example, under the cover term of "Guide to additional resources for learning," one teacher wrote in an online posting that she introduced her student teacher to the WebQuest site as a resource for a lesson:

> My student teacher was completing a lesson on States and Capitals. When I came back from the November class, I was armed! I told him about the site called [W]eb[Q]uest. During his computer lesson we introduced it to the students and they found so much information! It was very informative and he, the students and I all benefited from the Web site (ES-Case 2).

Items in the domain of "Instructional Practices" included activities that supported the student teachers' use of technology for instruction. For example, under the cover term of "Discuss curriculum connections," one teacher wrote in an online posting: "I talked with my student teacher about the different things we/he could do with technology. As we were talking, we compiled a list of ideas" (MS Case 4). She specifically mentioned using technology for creating instructional presentations, and having the students create presentations. A high school teacher mentioned he showed his student teacher how to create graphic organizers with computer software to help students learn the vocabulary and procedures in science. He talked about his steps for mentoring:

> Sometimes I do…graphic organizers. She'd never used them before…She told me, "You know, I find these really awkward to work with." So I showed her how…we use them. I modeled them for her to the class, and then I showed her how to make her own by using the computer to make them fit her lesson (HS Case 6).

Under the domain of "Productivity Practices" were items that referred to technology use to support the data gathering, data management, and professional communication practices in teaching. For example, under the cover term of "Model use of network communication," one middle school teacher commented: "We communicated via e-mail over weekends, or if she was working on a lesson plan at night she could send it to me at home and I could send her suggestions" (MS Case 3).

The domain of "Modeling Practices" included items in which cooperating teachers demonstrated lessons and modeled how to critique and reflect on those lessons for improvement. One interesting inclusion in this category is the cover term of "Team-teach." Two teachers specifically mentioned this practice. One teacher mentioned that the practice evolved early on during the student teaching experience as his student teacher became an active participant in the teaching process. He said: "For the first two or three weeks, we kind of team-taught. I'd open my mouth and I'd hear her voice, and I'd look around and she would finish saying what I was thinking" (MS Case 3). One student teacher also explained how team teaching helped her with management strategies during a computer lesson. She said,

> Literally, [my cooperating teacher] even helped me on my first lesson. She was kind of like the second teacher in the background. I realize that every little direction has to be explained because [the students] get excited. They want to go ahead; and she would chime in "OK, now before she goes on, don't touch your mouse pad or click anything" or whatever she would say that I would not think of (Student teacher, Case 1).

The final domain of "Support and Challenge Practices" included items that supported and challenged student teachers in the use of technology in the learning process, and also challenged the cooperating teachers to learn more about

mentoring and technology. For example, under the cover term of "Pose Challenges," one middle school teacher shared that after learning that her student teacher "was very computer literate," she began her support by offering him a challenge: "I told him that I'd like him to do one use of technology a week somewhere in his lessons." (MS Case 5) She noted in an online posting that "he has accepted this challenge." In his interview, the student teacher delineated the results of that challenge:

> I taught several different things that included technology. We taught lessons on researching using the Internet as a tool. For some projects they used word processing …and we also included in that graphics they could use…to jazz it up…. We used different software … where they used the computer in class and also in the computer lab. We did [computer presentations], so we used a variety of technology (Student teacher, Case 5).

## DISCUSSION

Few studies in the field of technology and teacher education address the technology context and mentoring practices of cooperating teachers to support technology use by student teachers, and little research in the mentoring literature specifically addresses how cooperating teachers mentor student teachers toward technology use. Thus, combining these two areas offers an opportunity for a fresh look at both practices.

### General Technology Context

Several trends were apparent in the data gathered related to the general technology context. First, student teaching placements in classrooms with more than one computer in the classroom supported increased opportunities for student teachers to develop lessons for student use of technology. In addition, student teacher access to laptops for home use supported their skill development and use of technology in teaching activities. Second, support from an on-site technology coordinator was noted as a strong resource in the context of supporting student teachers' use of technology. Examples cited included support in planning, identifying resources outside the classroom, instructional support in the form of modeling a lesson with students in a lab, and technical problem solving with equipment. Finally, regular or ready access to a computer lab supported student teacher instructional uses of technology for active student learning lessons.

### Mentoring Practices That Support Technology Use

Multi-case analyses along with triangulated data from student teachers suggest five trends in practices that supported student teacher use of technology. First was the trend of one-on-one tutoring in software applications and professional productivity practices. The case study teachers reported using one-on-one practices such as previewing software, showing school data collection practices, demonstrating grading programs and lesson-plan templates, and introducing

student teachers to district and departmental e-mail communication systems. The student teacher data verified these step-by-step approaches. As one student teacher commented, "The one-on-one is good because then I can feel free to just ask any questions that will come up."

A second trend in practice was modeling of technology use in professional practice. The cooperating teachers modeled presentations, student-centered learning activities, professional productivity practices such as attendance and grading programs, and use of e-mail for professional communication. One student teacher noted, "He would give the pre-test, give the information, teach it over several days and then follow it up with a PowerPoint with the words and pictures…. and I followed that model."

A third trend involved discussion and reflection on technology use with content area topics. The discussions included curriculum connections to specific pieces of software, suggestions for ways to experiment with integrating "new" software into learning activities, and reflections after those lessons. The cooperating teachers indicated that these connections could start either with the curricular content and then make a connection to technology, or the student teacher would suggest a piece of software with which they were familiar and the cooperating teacher would help make a connection to an appropriate use with a content-area activity. The cooperating teachers also noted that reflections after the lessons offered opportunities for the student teachers to examine their practice and discuss strategies for future practice.

A fourth trend was helping student teachers learn to tap other avenues of support for technology use. This included guiding them to the on-site technology coordinator for ideas and technical advice, as well as contacting other teachers on the staff to use as resources in planning and presentations.

A final trend identified in the multi-case analysis was that cooperating teachers encouraged technology use by offering a vision, establishing expectations, and posing challenges to their student teachers. Literature indicates that mentors should support and challenge novices to improve their teaching practice (Odell & Huling, 2000). During the workshop sessions and interviews, the cooperating teachers willingly shared the strategies they used to encourage and challenge their student teachers. One teacher noted that she had posed a challenge to her student teacher to "do one use of technology a week somewhere in his lessons." At the next session, other teachers reported that they, too, were trying that strategy. This collaborative sharing of practice supports research from Perry, Walton, and Calder (1999) that found teachers valued opportunities to learn from one another, and use that learning to experiment with new strategies in their own practice.

Articulating and defining teacher practice is a necessary first step in determining promising, effective, or exemplary practice. The mentoring practices defined in this study are not intended as a final answer, rather they are offered as a starting point to begin building the knowledge base on promising practices in mentoring student teachers toward technology use. This study adds to the bodies of literature on mentoring and technology integration and suggests a merging of those bodies to explore more fully approaches for preparing student teachers for 21st century classrooms.

**Implications for Those Who Plan Field Experience**

For those concerned with the field experience placements of student teachers in settings that will prepare them for work in 21st century classrooms, findings from this study suggest several considerations for selection of those placements. First, cooperating teachers should have adequate technology skills for modeling student-learning activities and professional productivity practices such as using electronic grade books or lesson plans. Student teachers working in classrooms where these practices are not modeled may face a greater challenge in learning to integrate technology into their practice and may be handicapped in the task of preparing future students for their place in our technological world.

Second, access to adequate levels of technology is an important factor in supporting student-teacher use of technology. If the focus during student teaching is to have the student teacher use technology, then working in a classroom with a single computer may be adequate. In this research, student teachers who only had access to a single computer in the classroom were able to learn productivity practices such as keeping electronic grade books, using lesson plan templates, and presenting computer-aided classroom presentations. However, they had no opportunity to explore, develop, and learn how to facilitate lessons that involved student use of technology with content-area topics. Therefore, if the focus during student teaching is to encourage the student teacher to develop teaching practices that integrate technology in active, student-centered lessons, this study suggests that placements limited to a single computer in the classroom without access to additional computers for student use may not be adequate. In order for student teachers to learn how to support student-centered lessons with technology, they need knowledgeable mentor teachers and adequate access to technology to practice and develop those lessons.

**School District/University Mentoring Partnerships**

In this study, the school district/university partnership was developed based on the convergence of four themes in research. First, recent research has begun exploring school district/university partnerships as a means of developing technology-using placements for student teachers (Dawson & Nonis, 2000; Strudler & Grove, 2002; Wetzel et al., 2001). Second, mentoring has been explored as a professional-development approach to help practicing teachers learn to use computers effectively (MacArthur et al., 1995). Third, recent mentoring research has called for the integration of new models of reform-minded instruction during mentoring to support the development of skills that novices and their students will need to flourish in tomorrow's classrooms (Wang & Odell, 2002). Finally, according to research from Sandholtz, Ringstaff, and Dwyer (1997), "Technology is a catalyst for change in classroom processes because it provides a distinct departure, a change in context that suggests alternative ways of operating" (p. 47).

At the convergence of these four themes is an intersection where technology use and mentoring programs come into focus. In mentoring programs designed to support cooperating teachers in their work with student teachers, the addition of technology use in teaching opens an opportunity for an altered context in which cooperating teachers become learners again as they are introduced to

new models for teaching with technology that can affect their mentoring practice with student teachers. Rather than merely suggesting that they change their practice to include technology, they can be introduced to new practices integrating technology with curriculum-based, student-centered activities that expose them to new models for teaching and learning. Sandholtz et al. (1997) state that "Instructional evolution is not simply a matter of abandoning beliefs but one of gradually replacing them with more relevant ones shaped by experiences in an altered context" (p. 48). The present study suggests that introduction of technology use in student teacher-mentoring programs provides the altered context that sets the stage for consideration of new practices. Odell and Huling (2000) noted that "Formal and ongoing professional development can provide the necessary foundation and structure for mentor growth" (p. 67). Based on results of the present study, school district/university partnerships that support the student teaching experience should consider supplemental programs for cooperating teachers addressing a dual focus on reform-minded mentoring strategies and student-oriented use of technology.

## RECOMMENDATION FOR FURTHER RESEARCH

Findings from this study represent a step in identifying promising practices for mentor teachers. Although the study is descriptive in nature, it does raise several key issues for future research. First, this study used self-report data to define the practices of cooperating teachers in mentoring student teachers to teach with technology. Further studies should be conducted using observation methods during the field experience to explore and define further the practices of cooperating teachers. Second, conducting longitudinal studies with cooperating teachers can provide more information on the conceptual perspectives of mentors and how those perspectives are impacted through professional development, and how that impact effects the development of student teachers. Third, this study examined the contextual, conceptual, and practical factors that affect the use of technology in the student-teaching experience. Future studies are needed to take a more systematic look at these and other factors that can lead to effective placements for student teachers. Such research could help identify parameters for a range of levels from minimal to optimal that support student-teacher integration of technology. Finally, Although the present study yielded information on the use of technology during their field experience, longitudinal research is needed to follow these student teachers into their first years of practice to determine the effects of this approach on their subsequent integration of technology in classroom practice. Such data would clearly inform future school/university collaboration pertaining to preparing teacher candidates to teach with technology.

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## References


Anderson, R. E., & Dexter, S. L. (2000). *School technology leadership: Incidence and impact.* Retrieved April 22, 2002 from the Center for Research on Information Technology & Organizations Web site: http://www.crito.uci.edu/tlc/findings.html

Becker, H. J., Ravitz, J. L., & Wong, Y. T. (1999). *Teacher and teacher-directed student use of computers and software.* Retrieved October 9, 2001 from the Center for Research on Information Technology & Organizations Web site: http://www.crito.uci.edu/tlc/findings/ComputerUse/html/startpage.htm

Bellingham Public Schools (2001, August 1). *Staff use of technology: 2001 Self-evaluation rubric.* Retrieved September 8, 2001, from http://www.bham.wednet.edu/technology/StafSlfAsmt.htm

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32–42.

Brush, T., Glazewski, K., Rutowski, K., Berg, K., Stromfors, C., Van-Nest, M. H. et al. (2003). Integrating technology in a field-based teacher training program: The PT3@ASU project. *Educational Technology Research and Development, 51*(1), 57–72.

Cochran-Smith, M. (1991). Reinventing student teaching. *Journal of Teacher Education, 42*(2), 104–118.

Cooper, J. M., & Bull, G. L. (1997). Technology and teacher education: Past practice and recommended directions. *Action in Teacher Education, 19*(2), 97–106.

Cuban, L. (1986). *Teachers and machines.* New York: Teachers College Press.

Darling-Hammond, L. (2000). Futures of teaching in American education. *Journal of Educational Change, 1*, 353–373.

Dawson, K. & Nonis, A. (2000). Preservice teachers' experiences in a K–12/university technology-based field initiative: Benefits, facilitators, constraints, and implications for teacher educators. *Journal of Computing in Teacher Education, 17*(1), 4–12.

Ertmer, P. A., Gopalakrishnan, S., & Ross, E. M. (2001). Technology-using teachers: Comparing perceptions of exemplary technology use to best practices. *Journal of Research on Computing in Education, 33*(5). Retrieved October 3, 2001, from http://www.iste.org/jrte/33/5/ertmer.html

Falba, C. J., Grove, K. J. Anderson, D. G, & Putney, L. G. (2001). Benefits of laptop computers for elementary teachers. *Journal of Research on Computing in Education, 33*(5). Retrieved September 9, 2001 from: http://www.iste.org/jrte/33/5/falba.html

Feiman-Nemser, S. (1983). Learning to teach. In L. S. Shulman & G. Sykes (Eds*.) Handbook of teaching and policy* (pp.150–170). New York: Longman.

Feiman-Nemser, S. (2001). Helping novices learn to teach: Lessons from an exemplary support teacher. *Journal of Teacher Education, 52*(1), 17–30.

Feiman-Nemser, S., & Floden, R. E. (1986). The cultures of teaching. In M. C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed.) (pp. 505–526). New York: Macmillan.

Feiman-Nemser, S., & Remillard, J. (1996). Perspectives on learning to teach. In F. B. Murray (Ed.), *The teacher educator's handbook* (pp. 63–91). San Francisco: Jossey-Bass Publishers.

Gold, Y. (1996). Beginning teacher support: attrition, mentoring, and induction. In J. Sikula, T. Buttery, & E. Guyton (Eds.), *Handbook of research on teacher education* (2nd ed.) (pp. 548–594). New York: Macmillan Library Reference.

Guyton, E., & McIntyre, D. J. (1990). Student teaching and school experiences. In W. R. Houston, M. Haberman, & J. Sikula (Eds.), *Handbook of research on teacher education* (pp. 514–534). New York: Macmillan.

Hasselbring, T., Smith, L., Glaser, C. W., Barron, L., Risko, V. J., Snyder, C., et al. (2000). *Literature review: Technology to support teacher development.* Retrieved May 25, 2001 from http://www.ericsp.org/pages/digests/EdTechPrep.htm

Hope, W. C. (1998). The next step: Integrating computers and related technologies into practice. *Contemporary Education, 69*(3), 137–140.

International Society for Technology in Education. (2000). National Educational Technology Standards for Teachers. Eugene, OR: ISTE.

Jones, B. F., Valdez, G., Nowakowski, J., & Rasmussen, C. (1995). *Plugging in: Choosing and using educational technology.* Retrieved October 15, 2001 from North Central Regional Educational Laboratory Web site: http://www.ncrel.org/sdrs/edtalk/toc.htm

Kahn, B. (2001). Portrait of success: Cooperating teachers and the student teaching experience. *Action in Teacher Education, 22*(4), 48–57.

Koerner, M. (1992). The cooperating teacher: An ambivalent partner in student teaching. *Journal of Teacher Education, 43*(1), 46–56.

Lortie, D.C. (1977). *Schoolteacher: A sociological study.* Chicago: University of Chicago Press.

MacArthur, C.A., Pilato, V., Kercher, M., Peterson, D., Malouf, D. & Jamison, P. (1995). Mentoring: An approach to technology education for teachers. *Journal of Research on Computing in Education, 28*(1), 46–62.

Moursund, D., & Bielefeldt, T. (1999). *Will new teachers be prepared to teach in a digital age? A national survey on information technology in teacher education.*

Retrieved April 11, 2001 from: http://www.mff.org/publications/publications.taf?page=154

NCATE. (1997). *Technology and the new professional teacher: Preparing for the 21st century classroom.* Retrieved June 21, 2001 from http://www.ncate.org/accred/projects/tech/tech-21.htm

Odell, S. J. (1986). Induction support of new teachers: A functional approach. *Journal of Teacher Education, 37*(1), 26–29.

Odell, S. J., & Huling, L. (Eds.). (2000). *Quality mentoring for novice teachers.* Indianapolis, IN: Kappa Delta Pi.

Perry, N. E., Walton, C., & Calder, K. (1999). Teachers developing assessments of early literacy: A community of practice project. *Teacher Education and Special Education, 22*(4), 218–233.

Ronnkvist, A., Dexter, S., & Anderson, R. E., (2000). *Technology support: Its depth, breadth, and impact in America's schools.* Retrieved February 22, 2002, from University of California, Irvine, Center for Research on Information Technology and Organizations Web site: http://www.crito.uci.edu/tlc/findings.html

Sandholtz, J. H., Ringstaff, C., & Dwyer, D. C. (1997*) Teaching with technology: Creating student-centered classrooms.* New York: Teachers College Press.

Spradley, J. P. (1980). *Participant observation.* Fort Worth, TX: Harcourt Brace.

Strudler, N., & Grove, K. J. (2002). Integrating technology into teacher candidates' field experiences: A two-pronged approach. *Journal of Computing in Teacher Education, 19*(2), 33–39.

Strudler, N. B., McKinney, M. O., Jones, W. P., & Quinn, L. F. (1999). First-year teachers' use of technology: Preparation, expectations, and realities. *Journal of Technology and Teacher Education, 7*(2), 115–129.

Strudler, N. & Wetzel, K. (1999). Lessons from exemplary colleges of education: Factors affecting technology integration in preservice programs. *Educational Technology Research & Development, 47*(4), 63–81.

Thomas, L., Larson A., Clift, R., & Levin, J. (1996). Integrating technology in teacher education programs. *Action in Teacher Education, 17*(4), 1–8.

Tjeerdsma, B. L. (1998). Cooperating teacher perceptions of and experiences in the student teaching practicum. *Journal of Teaching in Physical Education, 17*, 214–230.

Trotter, A. (1999). Preparing teachers for the digital age. [Electronic version]. *Education Week, 19*(4), 37–43.

U. S. Congress, Office of Technology Assessment. (1995, April). *Teachers and technology: making the connection.* OTA-EHR-616. Washington D.C: U. S. Government Printing Office.

Veal, M. L., & Rikard, L. (1998). Cooperating teachers' perspectives on the student teaching triad. *Journal of Teacher Education, 49*(2), 108–119.

Vygotsky, L. S. (1978). *Mind in society.* Cambridge: Harvard University Press.

Wang, J. (2001). Contexts of mentoring and opportunities for learning to teach: A comparative study of mentoring practice. *Teaching and Teacher Education, 17*, 51–73.

Wang J., & Odell, S. J. (2002). Mentored learning to teach and standards-

based teaching reform: A critical review. *Review of Educational Research, 72*(3), 481–586.

Wang, J., & Odell, S. J. (2003). Learning to teach toward standards-based writing instruction: Experiences of two preservice teachers and two mentors in an urban multicultural classroom. *Elementary School Journal, 104*(2), 147–174.

Wenglinsky, H. (1998). *Does it compute? The relationship between educational technology and student achievement in mathematics.* Retrieved June 11, 2001 from the Educational Testing Service Web site: http://www.ets.org/research/textonly/pic/pir.html

Wetzel, K., Zambo, R., Buss, R., & Padgett, H. (2001, June). *A picture of change in technology-rich K–8 classrooms.* Paper presented at the meeting of the National Educational Computing Conference, Chicago, IL.

Willis, J. (1993). What conditions encourage technology use? It depends on the context. *Computers in the Schools, 9*(4), 13–33.

Wilson, E. K. (2003). Preservice secondary social studies teachers and technology integration: What do they think and do in their field experiences? *Journal of Computing in Teacher Education, 20*(1), 29–39.

## APPENDIX

### Interview Questions

*Phase One: Initial Semi-structured Interview Questions for All Cooperating Teachers*

1. How long have you been teaching?
2. What grades or subject areas have you taught?
3. How do you think your students learn?
4. How many times have you had a student teacher?
5. How did you come to participate as a cooperating teacher in this project?
6. How long have your been working with this project?
7. What do you believe is your role in working with student teachers?
8. How do you think student teachers learn how to teach?
9. What do you believe student teachers need from cooperating teachers?
10. Do you find any personal or professional rewards or advantages in working with student teachers?
11. How do you use technology in your teaching?
12. What are some of the most important things your student teacher needs to learn about teaching with technology?

*Phase Two: Second Semi-structured Interview Questions for Selected Case-Study Cooperating Teachers*

1. What do you believe is your role concerning your student teacher's use of technology during student teaching?
2. What do you believe you can do to support you student teacher's use of technology?
3. What do you believe you need to do to help your student teacher learn how to teach with technology?
4. What resources beyond yourself did you guide your student teacher to use during the semester?

a) Did you recommend any web resources? Please identify.
b) Did you encourage them to consult with the technology coordinator? In what way?
c) Did you suggest any other teachers on staff as resources? For what specific purposes?
d) Did you identify any software resources? Which ones and why?

5. What strategies or practices did you use with your student teacher to help them integrate technology in their lessons?
6. What strategies or practices did you use with your student teacher to help them integrate technology in their professional practice?
7. Did you have any instances where you learned something about technology from your student teacher? Please describe.

*Phase Two: Semi-structured Interview Questions for Case-Study Student Teachers*

1. What are your views of technology use in the classroom?

a) How important do you think technology is in education? Please explain.

b) Do you see any advantages in using technology? Please explain.

c) Do you see any disadvantages? Please explain.

2. Were you able to teach any lessons using technology? Please describe.
3. How do you believe students learn and acquire new information?
4. Were you able to use technology to support other student learning activities? Please describe.
5. Do you believe your university courses prepared you for technology use in teaching and learning activities? Please explain.
6. What practices of your cooperating teacher helped support you in your use of technology in teaching situations?
7. What practices of your cooperating teacher helped support you in your use of technology for professional practice situations, such as keeping track of student data, using online communications, gathering research or information from the internet, or recording professional practice information such as lesson plans?
8. Were there any things your cooperating teacher did that you found particularly helpful in supporting or encouraging your use of technology?
9. Were there any factors that inhibited your use of technology?
10. Was there anything you would have liked your cooperating teacher to do to support your use of technology?
11. What are your plans for the future regarding technology use in education?